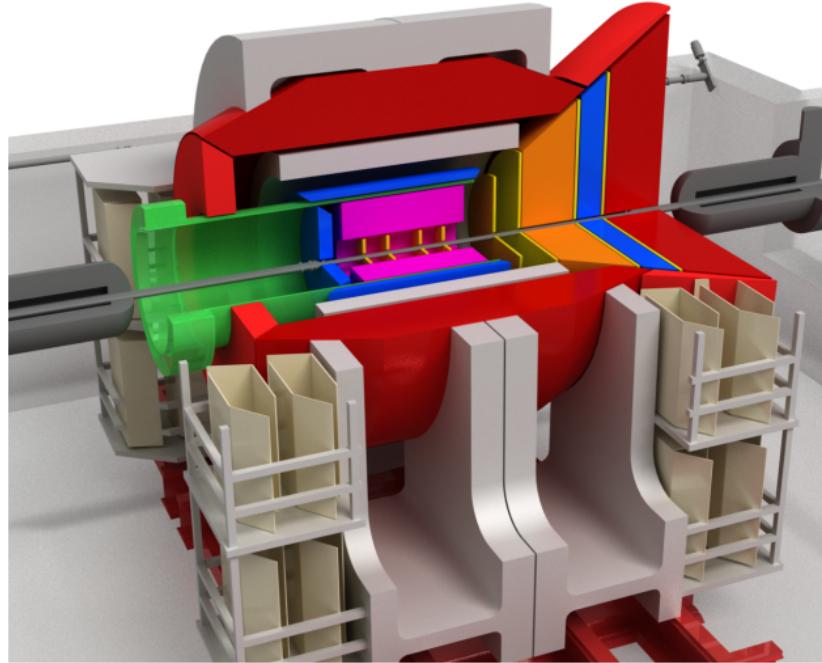


An EIC Detector Built Around
the BaBar Solenoid

Revisiting Lol Pythia Studies

June 2, 2015



Thomas Krahulik (Stony Brook University)

Revisiting Lol (2014) Plots

Energies:

10 GeV (e-) x 250 GeV (p) beam configuration

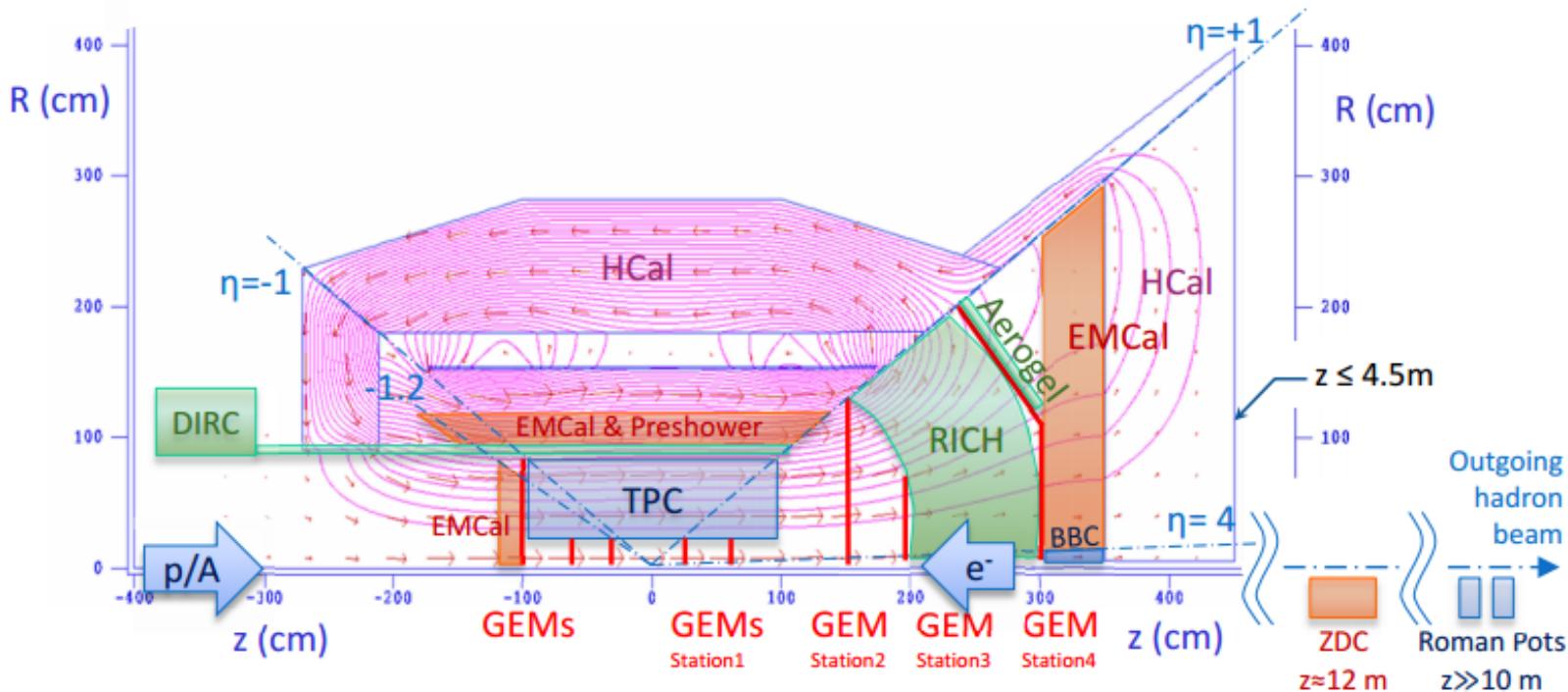
Event Numbers:

1 Million Events

Files Used:

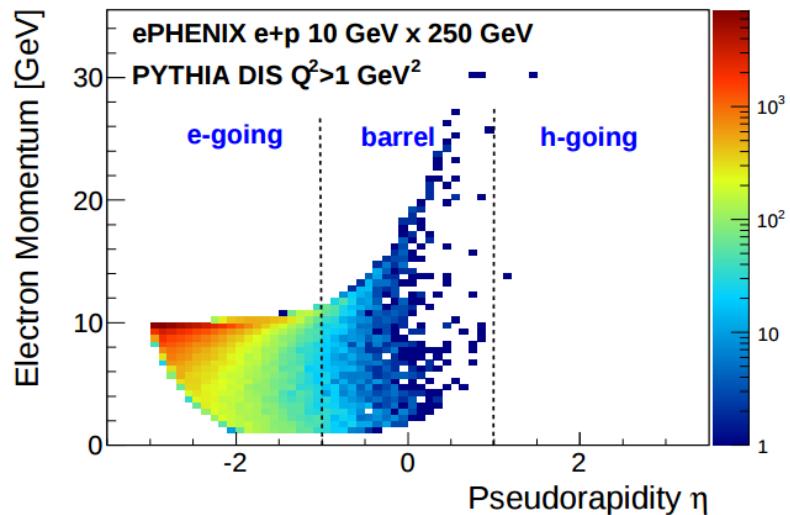
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pythia.ep.250x010.1000000events.seed505211968_Subset1M.root

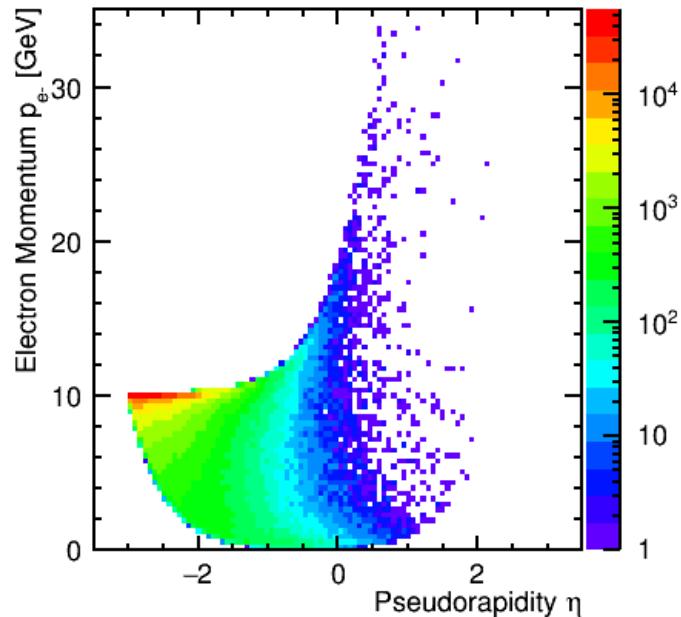


Lol Fig. 3-2: Cross-section of EIC Detector concept (for reference)

Electron Momentum vs. Pseudorapidity



Lol (2014) Figure 2.1



$Q^2 > 1 \text{ GeV}^2$

Hadron Momentum vs. Pseudorapidity

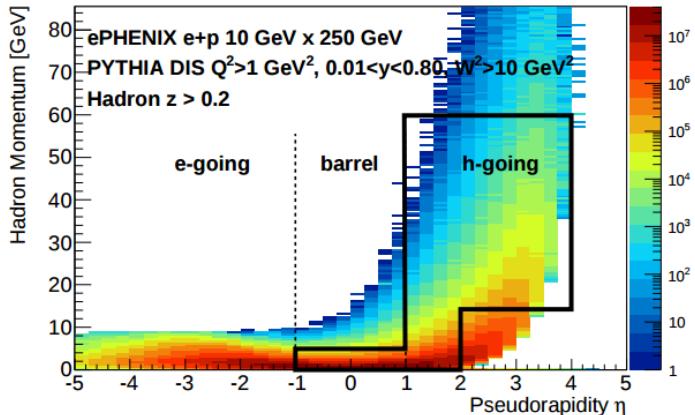
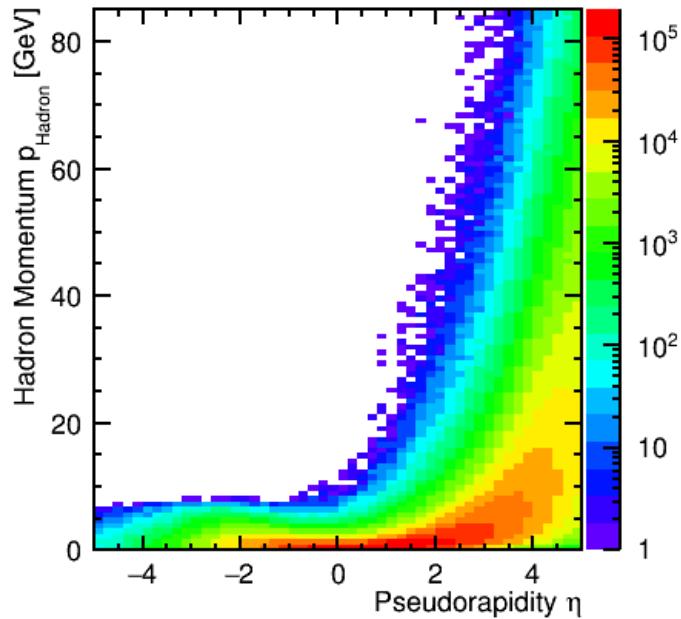


Figure 2.7: Shown is the distribution of hadrons from DIS events in $e+p$ as a function of momentum and pseudorapidity, based on PYTHIA simulations of the $10 \text{ GeV} \times 250 \text{ GeV}$ beam energy configuration. The black outline indicates the pseudorapidity and momentum range covered for kaons by the planned PID detectors in ePHENIX.



$Q^2 > 1 \text{ GeV}^2$, $0.01 < y < 0.80$, $W^2 > 10 \text{ GeV}^2$
No z cut

Lol (2014) Figure 2.7

Momentum Spectra

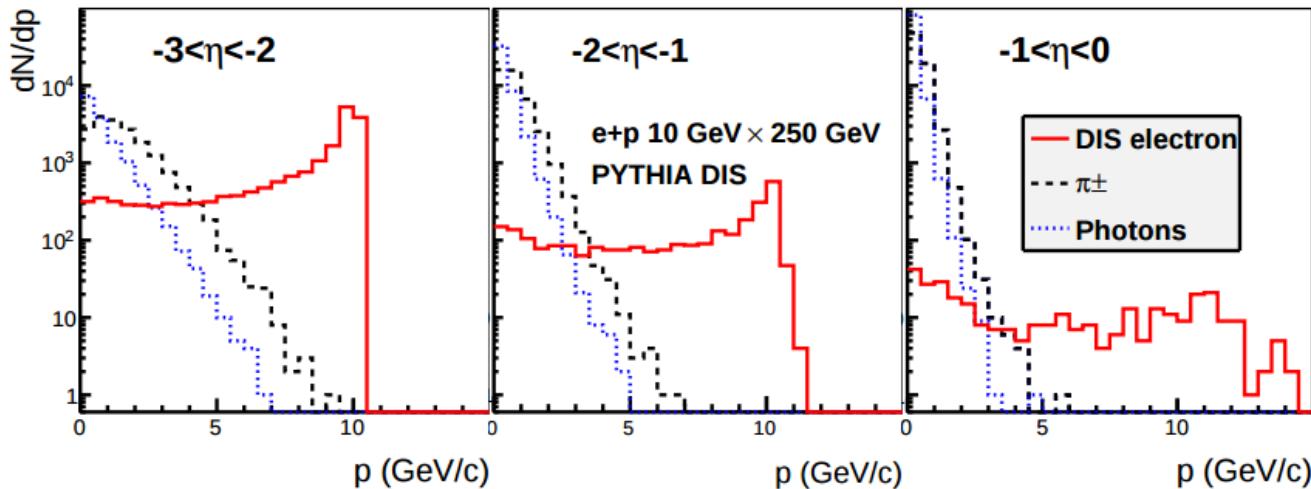
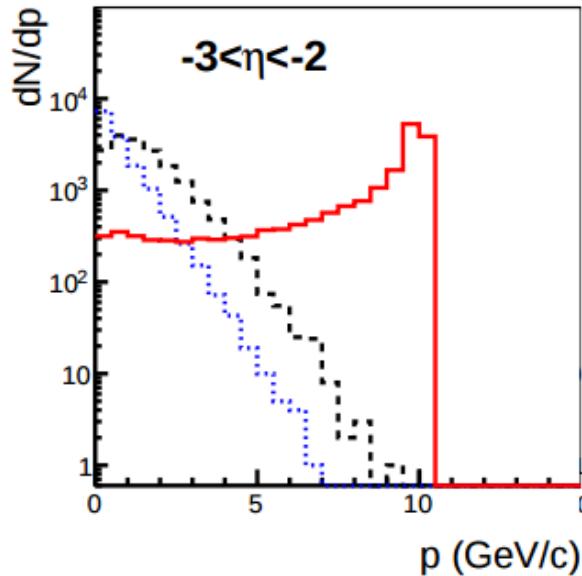
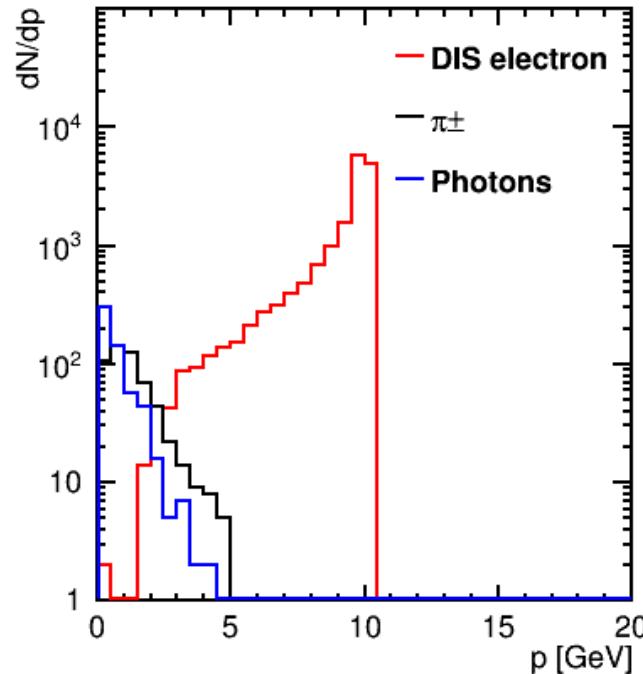


Figure 2.2: For 10 GeV \times 250 GeV beam energy configuration: Momentum spectra for scattered electron (red), charged pions (black) and photons (blue).

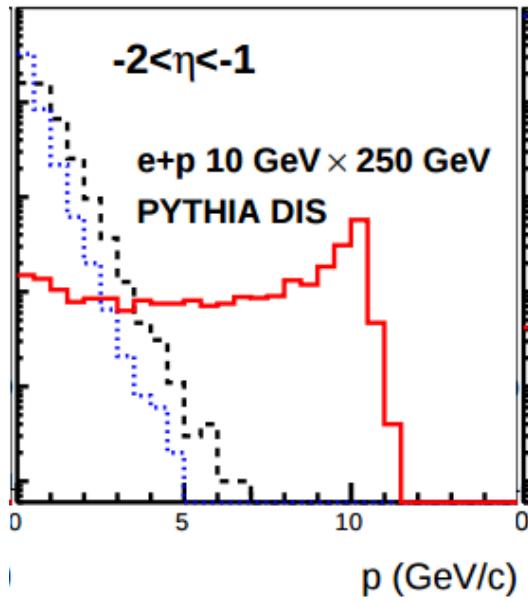
Momentum Spectra: $-3 < \eta < -2$



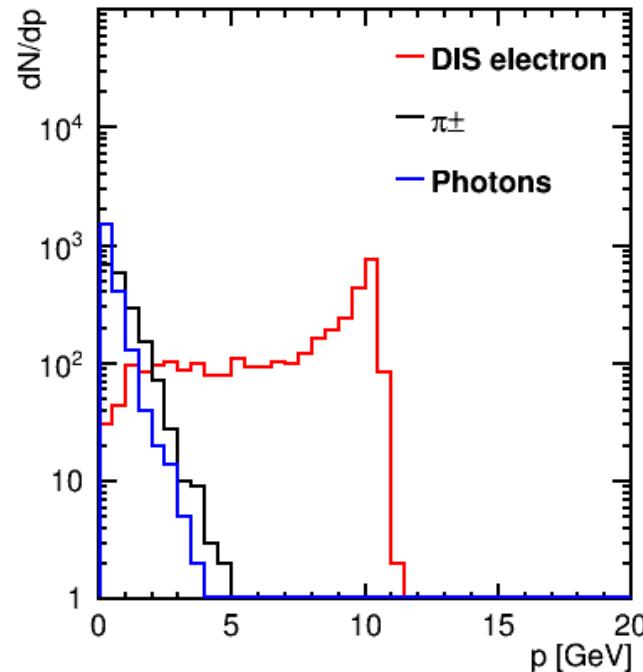
Lol (2014) Figure 2.2 (Left)



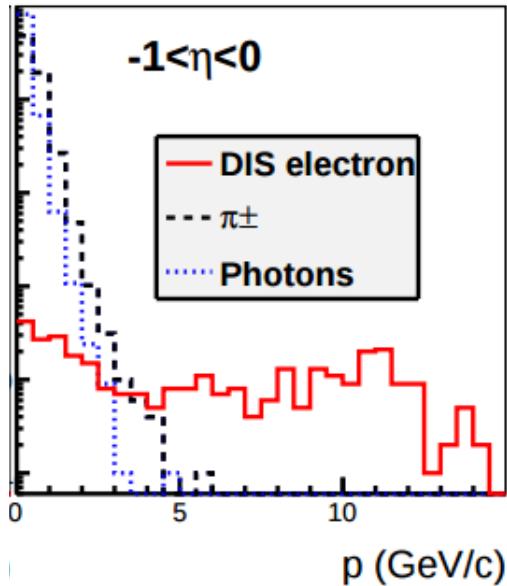
Momentum Spectra: $-2 < \eta < -1$



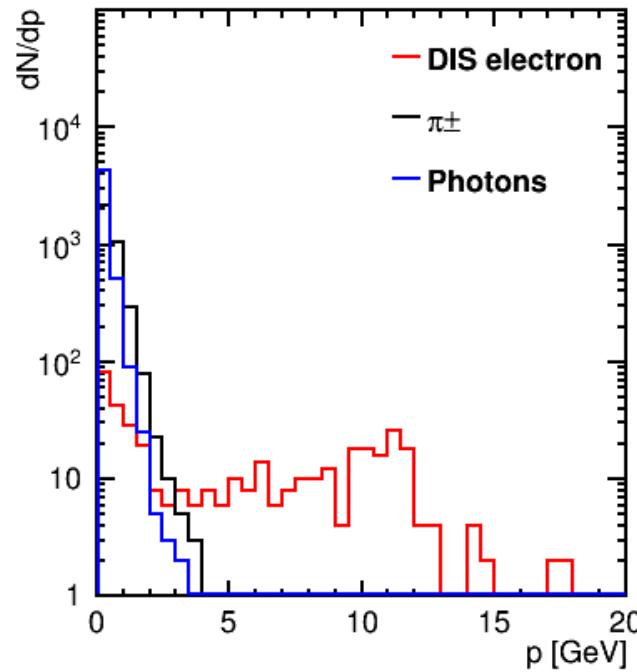
Lol (2014) Figure 2.2 (Center)



Momentum Spectra: $-1 < \eta < 0$



Lol (2014) Figure 2.2 (Right)



(x , Q^2) Space: Electrons after a >2 GeV Energy Cut

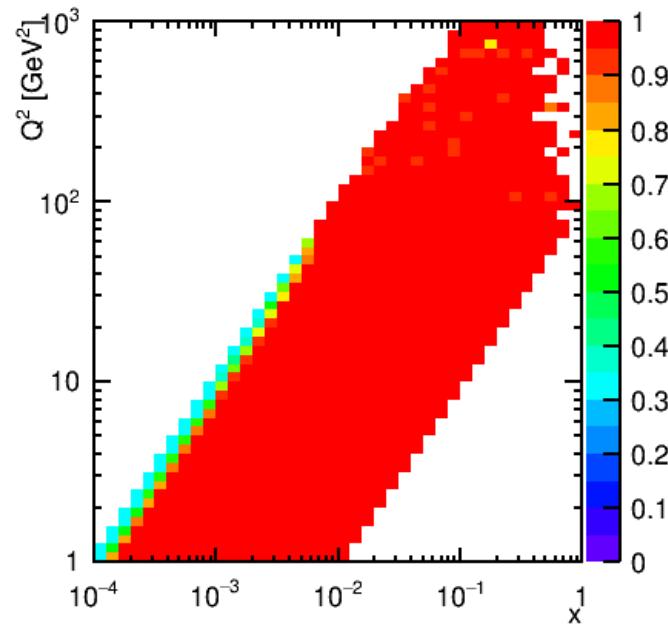
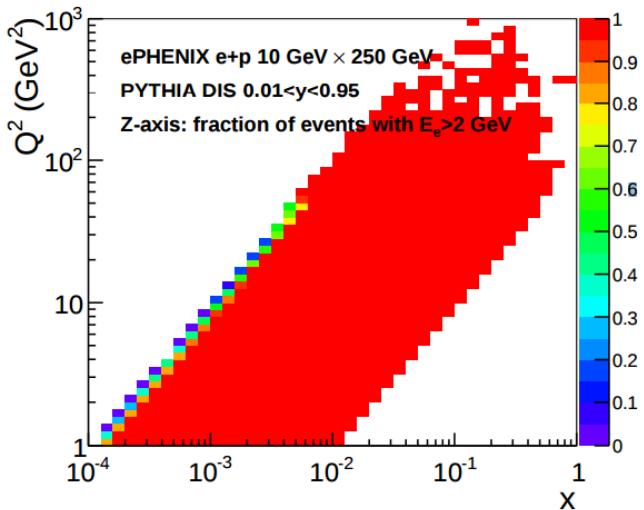


Figure 2.4: For 10 GeV \times 250 GeV beam energy configuration: The color axis indicates the fraction of events in (x, Q^2) space surviving after a >2 GeV energy cut on the DIS scattered electron.

Lol (2014) Figure 2.4

$0.01 < y < 0.95, x > 1$

(x , Q^2) Space: Kaon Identification

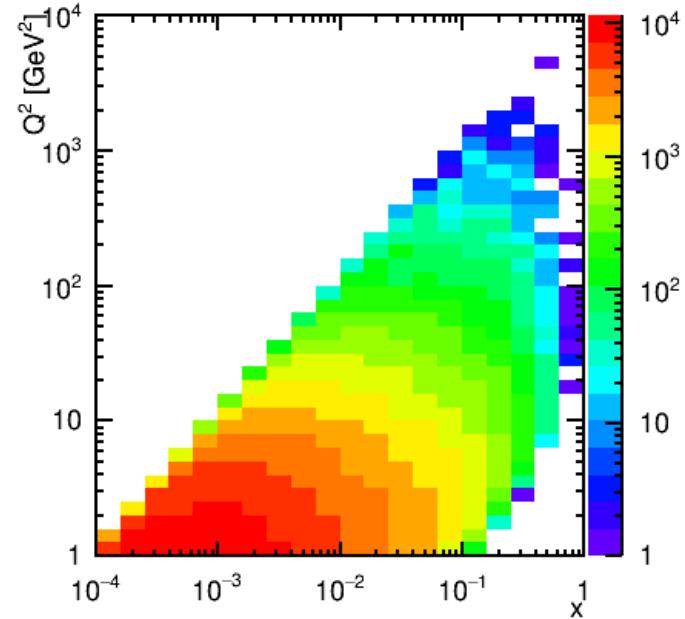
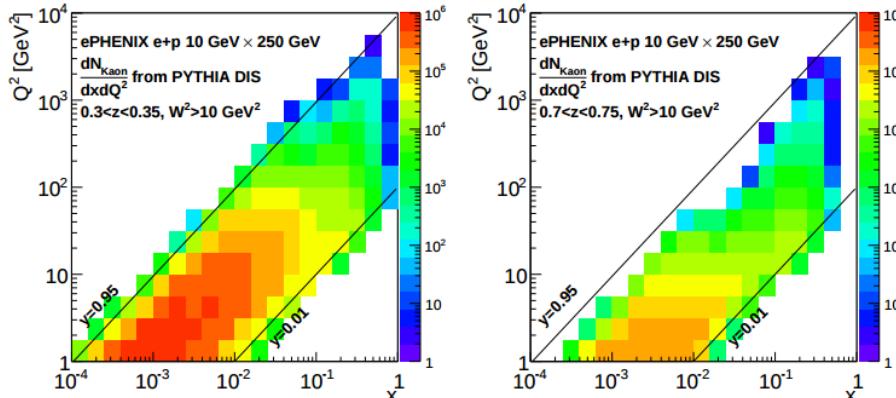
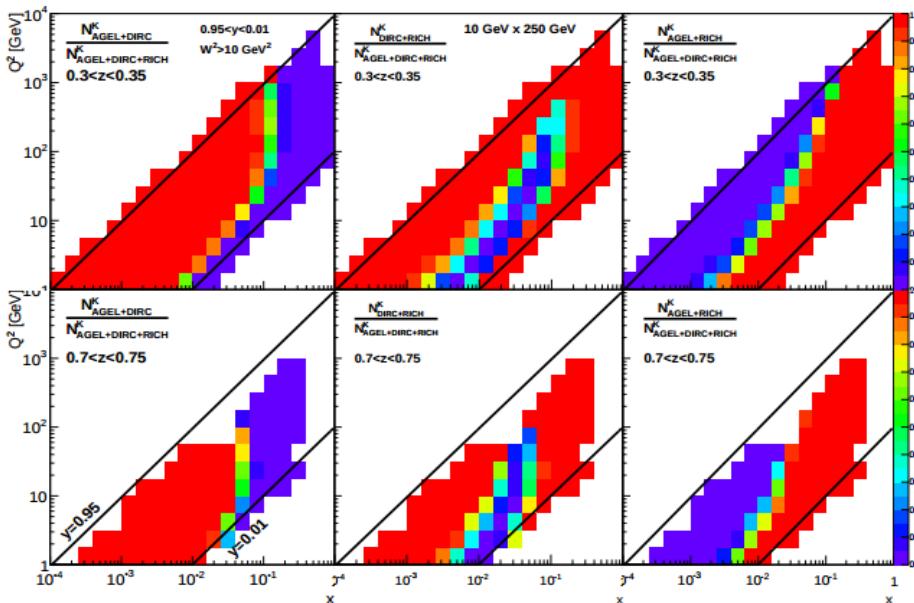


Figure 2.8: x and Q^2 distribution of events with kaons which can be identified with the ePHENIX PID detectors in expected binning at (left) low and (right) high z .

Lol (2014) Figure 2.4

$W^2 > 10 \text{ GeV}^2$
 No z cut

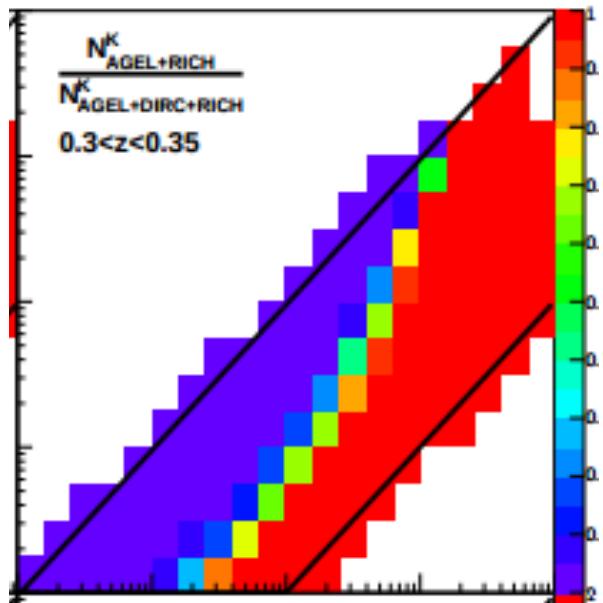
(x , Q^2) Space: Efficiency Kaon Identification



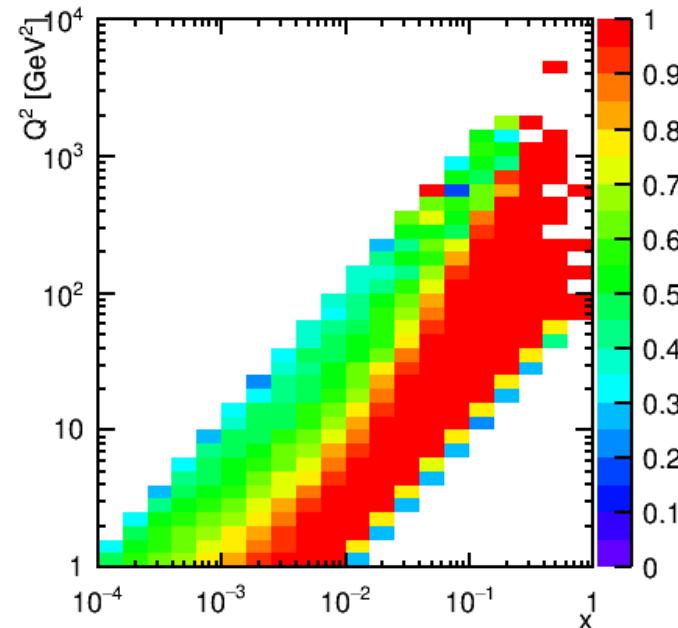
Lol (2014) Figure 2.9

Figure 2.9: Efficiency as a function of x and Q^2 of kaon identification when comparing to baseline ePHENIX design with a DIRC, RICH and Aerogel when one of these subsystems is removed. The top three plots are for low z ($0.3 < z < 0.35$) and the bottom three are for high z ($0.7 < z < 0.75$). Also shown are lines indicating different values of y .

(x , Q^2) Space: Efficiency of Kaon Identification



Lol (2014) Figure 2.9 (Upper Right)



$0.01 < y < 0.95$, $W^2 >$ GeV 2
No z cut

Energy Studies: Initial Steps

- L0I studies utilized a 10 GeV x 250 GeV beam configuration
- Following slides use varying energies of both electron and proton
- Files Used (all previously generated):

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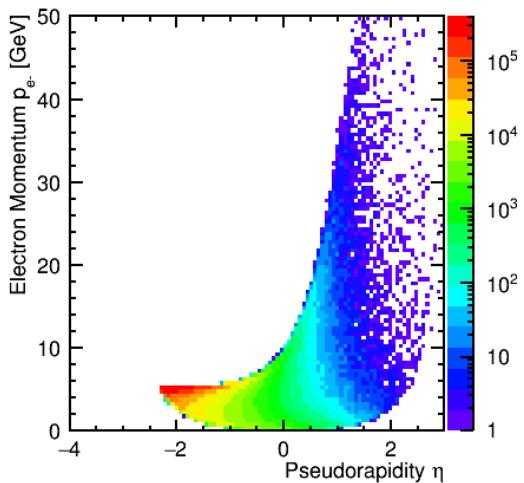
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pythia.ep.250x005.1000000events.seed558119075.root

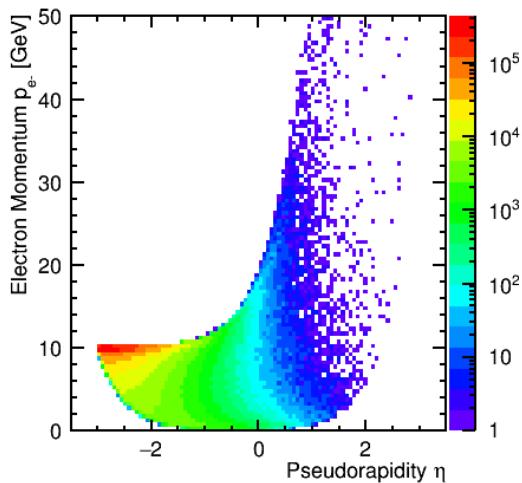
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pythia.ep.250x015.1000000events.seed153070071.root

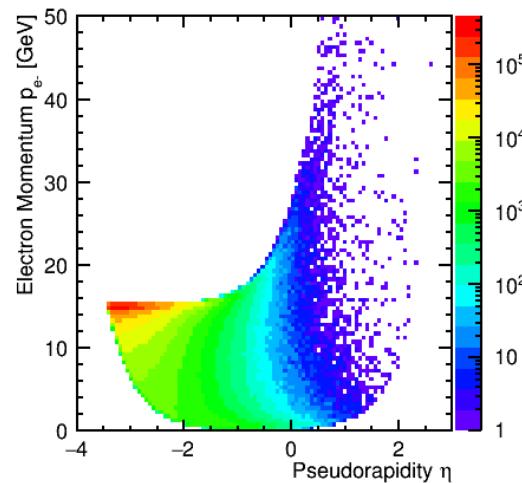
Energy Studies



5 GeV x 250 GeV

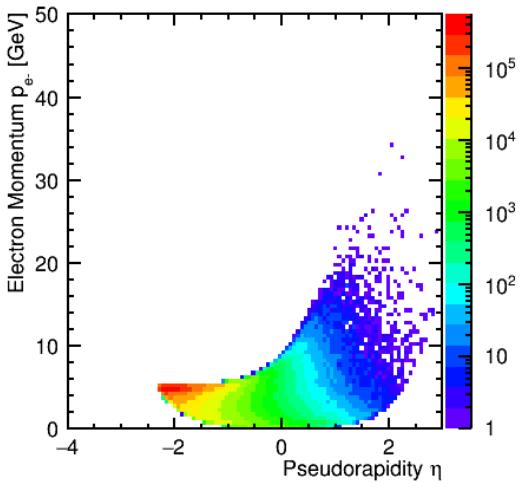


10 GeV x 250 GeV

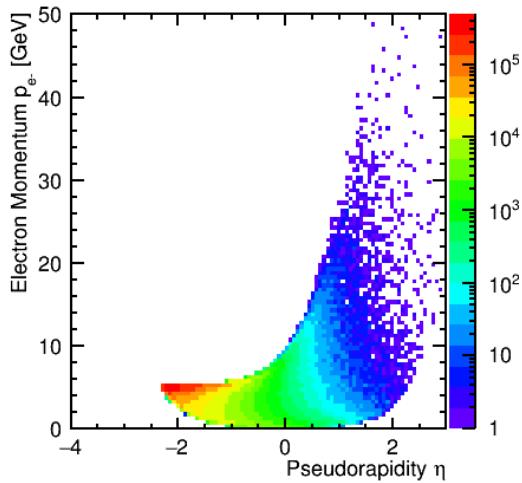


15 GeV x 250 GeV

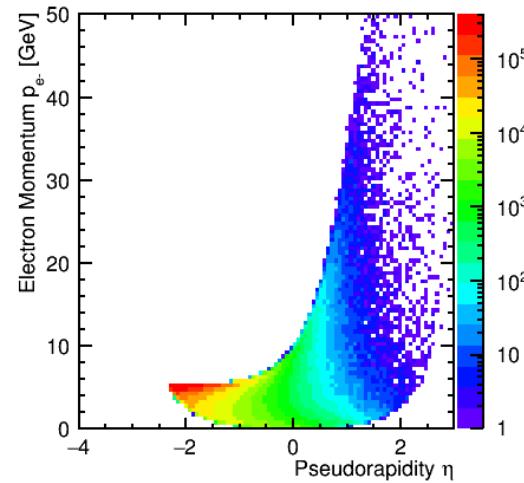
Energy Studies



5 GeV x 50 GeV

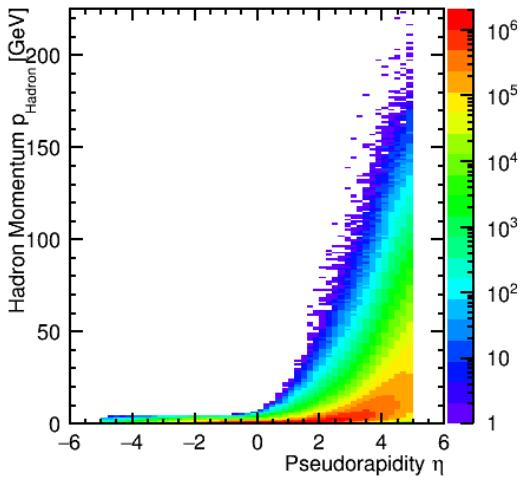


5 GeV x 100 GeV

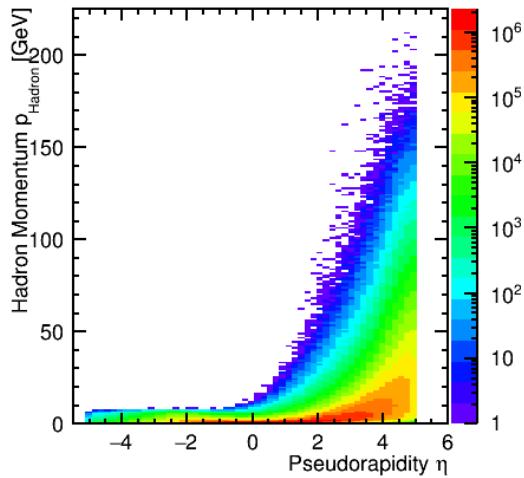


5 GeV x 250 GeV

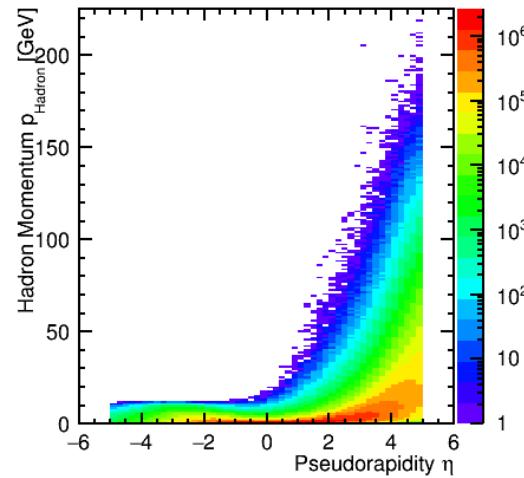
Energy Studies



5 GeV x 250 GeV

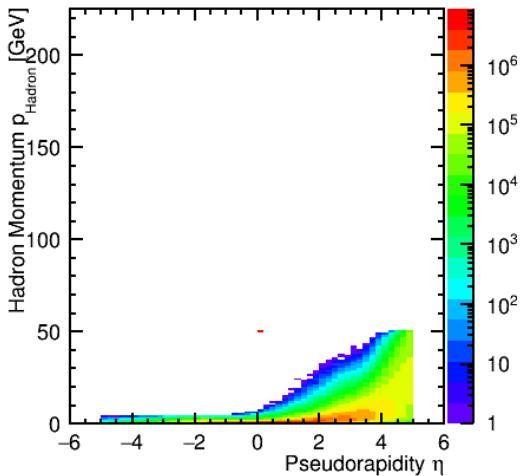


10 GeV x 250 GeV

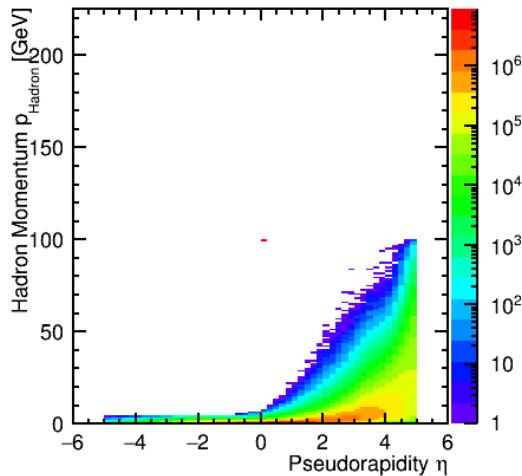


15 GeV x 250 GeV

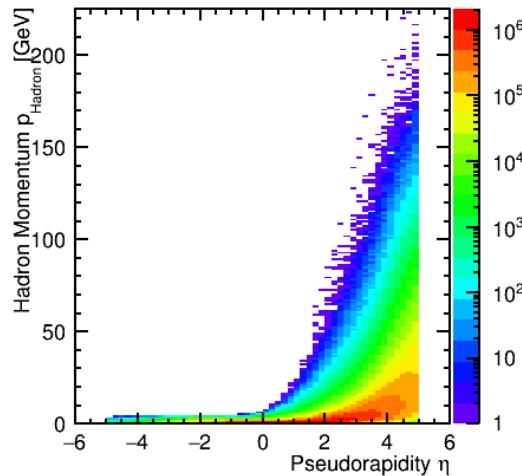
Energy Studies



5 GeV x 50 GeV



5 GeV x 100 GeV

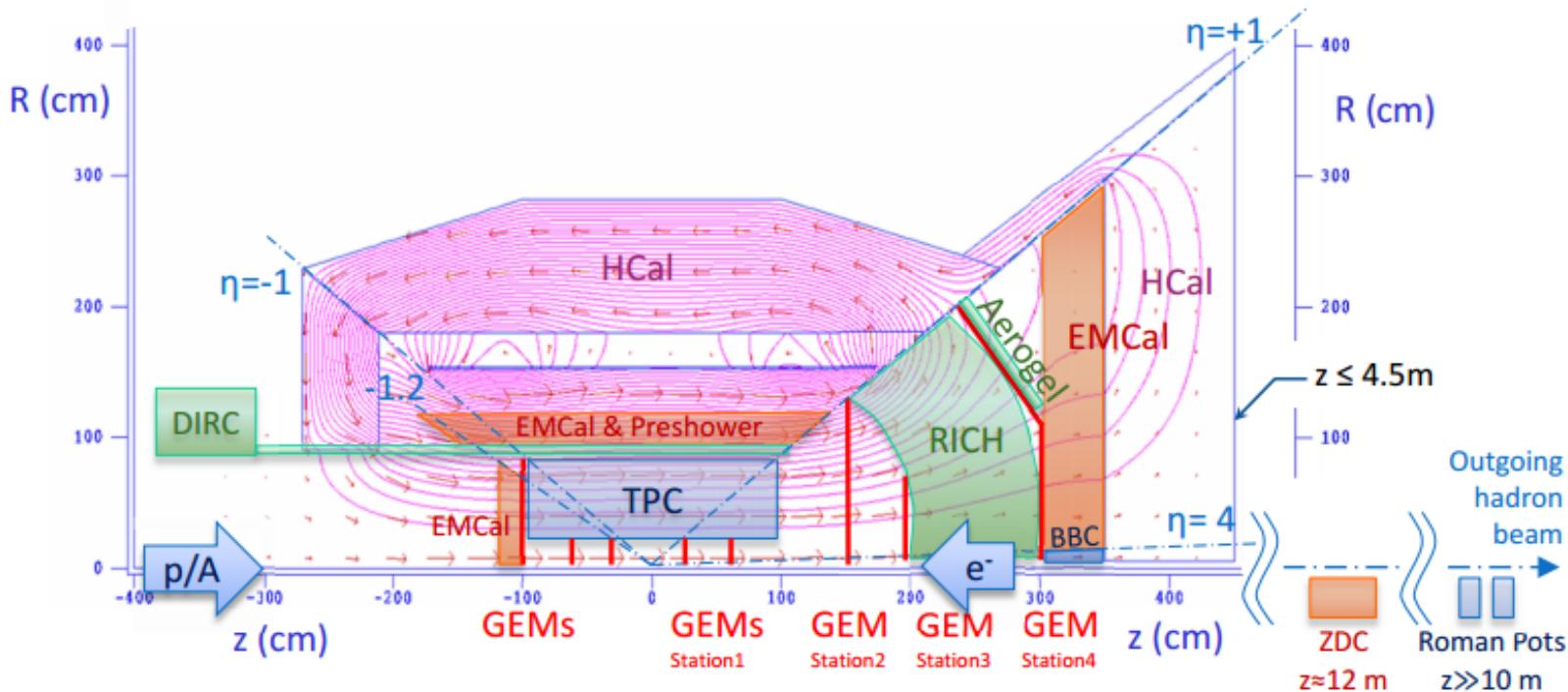


5 GeV x 250 GeV

Future Steps...

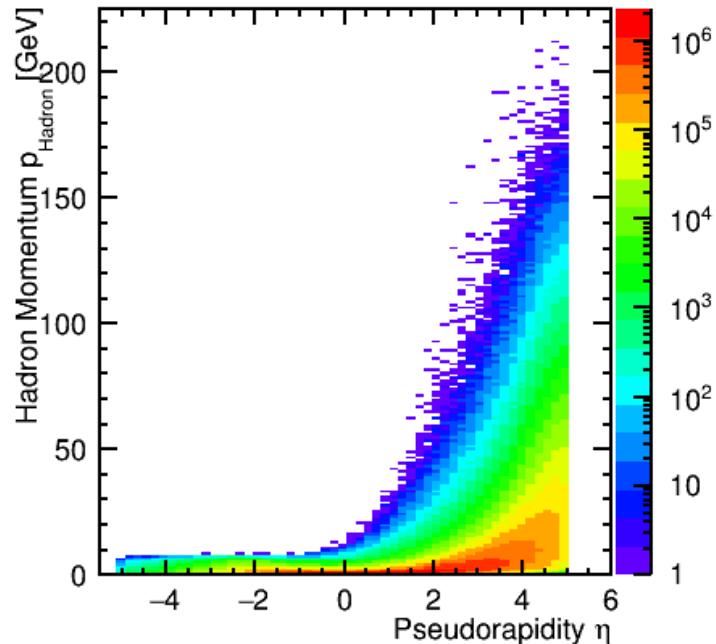
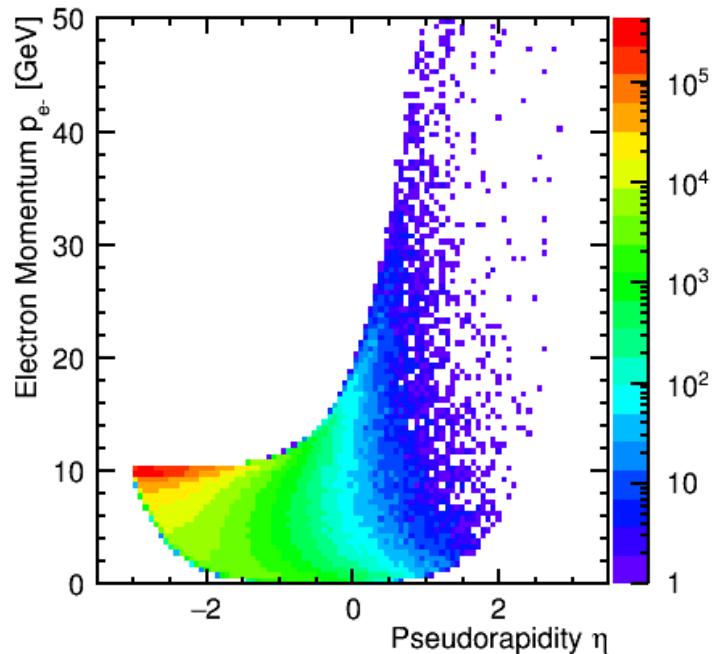
- Finish original Lol Plots (Incorporate z cuts, Fig. 2-9, etc.)
- Re-do plots with new detector acceptance
- Generate e-p collisions in Pythia with different beam configurations
- Use higher collision energies to expand upon Lol studies

Additional Slides



Lol Fig. 3-2: Cross-section of EIC Detector concept (for reference)

10 Million Events



10 GeV x 250 GeV, 10 million events, Electrons (Left) and Hadrons (Right)

References

Concept for an Electron Ion Collider (EIC) detector built around the BaBar solenoid (EIC Lol 2014 arXiv:1402.1209 v1)